THE TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW.

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FIRE ALARMS.

THE authorities of the City of London appear at last to be waking up to the necessity of some system of alarms for summoning aid in case of fire. Whether this is due to the feeling that public opinion will imperatively require something to be done in the matter before long, or to a desire to show that scientific appliances should have opportunities of being tested, or to any other reason, is of little importance; but the fact remains that a too long delayed means of adding to the security of property and of life will now have a fair trial.

Every credit must be given to the authorities in charge of the Metropolitan Fire Brigade for the efficiency to which that department has been brought. The interval between the receipt of the alarm and the despatch of the engines is marvellously small—in fact, could hardly be less; but the same cannot be said of the time occupied between the outbreak of a fire and the announcement of the alarm at the police or fire station. The number of stations in the Metropolis must necessarily be limited, and the distance between the same and the houses over which they keep guard must in many cases be considerable, consequently some more expeditious means of carrying the alarm than the foot messenger is obviously required. As is well known, the Americans have long since fully recognised this, and their system of alarms is very perfect.

A stimulus will no doubt be given to the matter from the alarming frequency with which disastrous fires have taken place of late in the Metropolis, and it will only want a few cases to take place, as they assuredly will, in which the electric warning will have been of most material use in enabling the progress of fires to be checked at the outset, to cause a considerable extension of the trial systems and their eventual permanent adoption. At present two systems will be under trial, viz., that of Mr. Edward Bright, which was fully described in the number of this journal for Feb. 15th, 1879. The other system is that of the Exchange Telegraph Company, and is like in principle to the one most generally employed in the United States. This system has the advantage that it indicates to the communicator of the alarm whether his signal has been received or not. The signalling apparatus is enclosed in an iron case similar to a postal pillar-box. The erection of these fire alarm boxes at the corners of the streets excites the usual public curiosity, and it is to be hoped that when the systems are set in working order they will prove as valuable as they ought. It is by no means a creditable fact that the Metropolis should have been left for so long a period without such an essential adjunct to the Fire Brigade force; this disgrace seems now likely to be wiped out, and as soon as full scope is given to the system we may hope to see a very considerable diminution in the large and disastrous fires, both to life and property, which are now of such frequent occurrence.

ON ELECTRIC LIGHTING.

By DR. JOHN HOPKINSON, F.R.S., of London.

(SECOND PAPER.)

Read before the Institution of Mechanical Engineers.

Dynamo-electric Machines.—Since the date of the author's former paper in April, 1879,* other observers have published the results of experiments similar to those described by him. These results reduced to a curve, in which the abscissæ represent a current passing through the dynamo-electric machine, and the corresponding ordinates represent the electromotive force of the machine for a certain speed of revolution, when that current is passing through it, show the following results:—It will be found (1) that with varying speed the ordinate, or electromotive force, corresponding to any abscissa or current, is proportional to the speed; (2) that the electromotive force does not increase indefinitely with increasing current, but that the curve approaches an asymptote; (3) that the earlier part of the curve is, roughly speaking, a straight line, until the current attains a certain value, and that at that point the electromotive force has reached about two-thirds of its maximum value. When the current is such that the electromotive force is not more than two-thirds of its maximum, a very small change in the resistance with speed of engine constant, or in the speed of the engine with resistance constant, causes a great change in the current. For this reason such a current, which is the same for all speeds of revolution, since the curves for different speeds differ only in the scale of ordinates, may be called the "critical current" of the machine.

In Germany, Auerbach and Meyer (Wiedemann's Annalen, Nov., 1879) have experimented fully on a Gramme machine at various speeds, and with various external resistances. The resistance of the machine was 0·97 ohms. Their results are summarised in a table at the end of their paper, which gives the current passing, with resistances in circuit from 1·75 to 200 Siemens units, and at speeds from 20 to 800 revolutions per minute. The relation between electromotive force and current, as deduced from some of their observations, showed that at a speed

* *Telegraphic Journal*, May 15th, 1879.

of 800 revolutions the maximum electromotive force is about 76 volts; the critical current, corresponding to a force of about 51 volts, is 6·5 webers, with a total resistance of 7·8 ohms. Up to this point there will be great instability, exactly as was the case in the Siemens machine examined by the author, where the resistance was 4 ohms, and the speed 720 revolutions.

The results of an elaborate series of experiments on certain dynamo-electric machines have recently been presented to the Royal Society by Dr. Siemens. One of the machines examined was an ordinary medium-sized machine, substantially similar to that tried by the author in 1879. It is described as having 24 divisions of the commutator; 336 coils on the armature, with a resistance of 0·4014 Siemens units; and 512 coils on the magnets, with a resistance of 0·3065; making a total resistance of 0·7079 Siemens units = 0·6654 ohms. In this case the maximum electromotive force appears to be probably 76 volts, and the critical current 15 webers, which is the same as in the author's first experiments on a similar machine.

In the summer of 1879 the author examined a Siemens machine of the smallest size. This machine is generally sold as an exciter for their alternate current machine. It has an internal resistance of 0·74 ohms, of which 0·395 is in the armature or helix. The machine is marked to run at 1130 rev. per min. The following table gives, for a speed of 1000 rev., the total resistance, current, electromotive force, and horse-power developed as current. The horse-power expended was not determined.

EXPERIMENTS ON SMALLEST-SIZED SIEMENS DYNAMO-ELECTRIC MACHINE.

Resistance.	Electric Current.	Electromotive Force.	Horse-power developed as current.
Ohms.	Webers.	Volts.	H.-P.
2·634	4·53	13·2	0·08
2·221	10·8	27·0	0·39
1·967	15·1	33·6	0·68
1·784	18·1	36·4	0·88
1·668	19·8	37·2	0·98
1·579	20·6	36·6	1·01
1·503	22·8	39·3	1·20
1·440	24·7	40·0	1·32
1·145	32·2	41·5	1·79

In this case the critical current is 11·2 webers, and the maximum electromotive force, at the speed of 1000 rev., is about 42 volts. The determinations for this machine were made in exactly the same manner as in the experiments on the medium-sized machine, using the galvanometer, but omitting the experiment with the calorimeter (compare Table I., page 249, Proceedings, April, 1879).

The time required to develop the current in a Gramme machine has been examined by Herwig (Wiedemann, June, 1879). He established the following facts for the machine he examined. A reversed current, having an electromotive force of 0·9 Grove cells, sufficed to destroy the residual magnetism of the electro-magnets. If the residual magnetism was as far as possible reduced, it took a much longer time to get up the current than when the machine was in its usual state. A longer time was required to get up the current when the external resistance was great than when it was small. With ordinary resistance the current required from ¾ second to 1 second to attain its maximum.

Brightness of the Electric Arc.—The measurement of the light emitted by an electric arc presents certain peculiar difficulties. The light itself is of a different colour from that of a standard candle, in terms of which it is usual to express luminous intensities. The statement, without qualification, that a certain electric lamp and machine give a light of a specified number of candles, is therefore wanting in definite meaning. A red light cannot with propriety be said to be any particular multiple of a green light; nor can one light, which is a mixture of colours, be said with strictness to be a multiple of another, unless the proportions of the colours in the two cases are the same. Captain Abney (Proceedings of the Royal Society, March, 1878) has given the results of measurements of the red, blue, and actinic light of electric arcs, in terms of the red, blue, and actinic light of a standard candle. The fact that the electric light is a very different mixture of rays from the light of gas or of a candle, has long been known, but has been ignored in statements intended for practical purposes.

Again, the emission of rays from the heated carbons and arc is by no means the same in all directions. Determinations have been made in Paris of the intensity in different directions, in particular cases. If the measurement is made in a horizontal direction, a very small obliquity in the crater of the positive carbon will throw the light much more on one side than on the other, causing great discordance in the results obtained.

If the electric light be compared directly with a standard candle, a dark chamber of great length is needed—a convenience not always attainable. In the experiments made at the South Foreland by Dr. Tyndall and Mr. Douglass, an intermediate standard was employed; the electric light was measured in terms of a large oil lamp, and this latter was frequently compared with a standard candle.

Other engagements have prevented the author from fairly attacking these difficulties; but since May, 1879, he has had in occasional use a photometer with which powerful lights can be measured in moderate space. This photometer consists of a lens of short focus, which forms an image of the powerful source of light which it is desired to examine. The intensity of the light from this image will be less than that of the actual source by a calculable amount; and when the distance of the lens from the light is suitable, the reduction is such that the reduced light becomes comparable with a candle or a carcel lamp. Diaphragms are arranged in the cell which contains the lens, to cut off stray light. One of these is placed at the focus of the lens, and has a small aperture. It is easy to see that this diaphragm will cut off all light entering from a direction other than that of the source; so effectually does it do so that observations may be made in broad daylight on any source of light, if a dark screen be placed behind it. A long box about 7 ft. length, is lined with velvet—the old-fashioned dull velvet—not that now sold with a finish, which reflects a great deal of the light incident at a certain angle. This box serves as a dark chamber, in

which the intensity of the image formed by the lens is compared with a standard light, by means of an ordinary Bunsen's photometer sliding on a graduated bar.

Mr. Dallmeyer kindly had the lens made for the author: he can therefore rely upon the accuracy of its curvature and thickness; it is plano-convex, the convex side being towards the source of light. The curvature is exactly 1 in. radius and the thickness is 0·04 in.; it is made of Chance's hard crown glass, of which the refractive index for the D line in the spectrum is 1·517. The focal length f is therefore 1·933 inch.

Let u denote the distance of the source of light from the curved surface of the lens, and v the distance of the image of the source from the posterior focal plane. Neglecting for the moment loss by reflection at the surface of the glass, the intensity of the source is reduced by the factor $\left(\frac{v}{u}\right)^2$. But $\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$, or $v=\frac{uf}{u-f}$; hence the factor of reduction is $\left(\frac{f}{u-f}\right)^2$. The effect of absorption in so small a thickness of very pure glass may be neglected; but the reflection at the surfaces will cause a loss of 8·3 per cent., which must be allowed for. This percentage is calculated from Fresnel's formulæ, which are certainly accurate for glasses of moderate refrangibility, and for moderate angles of incidence.

Suppose, for example, it is required to measure a light of 8,000 candles; if it be placed at a distance of 40 in., it will be reduced in the ratio 467 to 1, and becomes a conveniently measurable quantity. By transmitting through coloured glasses both the light from an electric lamp and that from the standard, a rough comparison may be made of the red or green in the electric light with the red or green in the standard.

A dispersive photometer, in which a lens is used in a somewhat similar manner, is described in Stevenson's "Lighthouse Illumination;" but in that case the lens is not used in combination with a Bunsen's photometer, nor with any standard light. Messrs. Ayrton and Perry described a dispersive photometer with a concave lens, at the meeting of the Physical Society, on 13th December, 1879 (Proc. of the Physical Society, vol. iii., p. 184). The convex lens possesses however an obvious advantage in having a real focus, at which a diaphragm to cut off stray light may be placed.

Efficiency of the Electric Arc.—To define the electrical condition of an electric arc, two quantities must be stated—the current passing, and the difference of electric potential at the ends of the two carbons. Instead of either one of these, we may, if we please, state the ratio $\frac{\text{difference of potential}}{\text{current}}$, and call it the resistance of the arc, that is to say, the resistance which would replace the arc without changing the current. But such a use of the term electric resistance is unscientific; for Ohm's law, on which the definition of electric resistance rests, is quite untrue of the electric arc; and on the other hand, for a given material of the electrodes, a given distance between them, and a given atmospheric pressure, the difference of potential on the two sides of the arc is approximately constant. The product of the difference of potential and the current is of course equal to the work developed in the arc; and this, divided by the work expended in driving the machine, may be considered as the efficiency of the whole combination. It is a very easy matter to measure these quantities. The difference of potential on the two sides of the arc may be measured by the method given by the author in his previous paper, by an electrometer, or in other ways. The current may be measured by an Obach's galvanometer, by a suitable electro-dynamometer, or best of all, in the author's opinion, by passing the whole current, on its way to the arc, through a very small known resistance, which may be regarded as a shunt for a galvanometer of very high resistance, or to the circuit of which a very high resistance has been added.

It appears that with the ordinary carbons and at ordinary atmospheric pressure no arc can exist with a less difference of potential than about 20 volts; and that in ordinary work, with an arc about $\frac{1}{4}$ in. long, the difference of potential is from 30 to 50 volts.

The success of burning more than one regulating lamp in series depends on the use in the regulator of an electro-magnet, excited by a high resistance wire connecting the two opposed carbons. The force of this magnet will depend upon the difference of potential in the arc, instead of depending, as in the ordinary lamp, upon the current passing. Such a shunt magnet has been employed in a variety of ways. The author has arranged it as an attachment to an ordinary regulator: the shunt magnet actuates a key, which short-circuits the magnet of the lamp when the carbons are too far parted, and so causes them to close.

In conclusion the author ventures to remind engineers of the following rule for determining the efficiency of any system of electric lighting in which the electric arc is used, the arc being neither exceptionally long nor exceptionally short. Measure the difference of potential of the arc, and also the current passing through it, in volts and webers respectively; then the product of these quantities, divided by 746, is the horse-power developed in that arc. It is then known that the difference between the horse-power developed in the arc and the horse-power expended to drive the machine must be absolutely wasted, and has been expended in heating either the iron of the machine or the copper conducting wires.

ON THE MECHANICAL TRANSMISSION OF SOUND BY WIRES, AND ON SIMPLE FORMS OF MICROPHONE RECEIVERS.

By W. J. MILLAR, C.E., Sec. Inst. Engineers and Shipbuilders in Scotland.

(Continued from page 153.)

SIMPLE FORMS OF MICROPHONE RECEIVERS.

WHEN carrying out some experiments with the microphone, having a galvanometer in circuit, it occurred to the author that, since the wires during mechanical transmission, as already described, must be in a state of varying strain from the vibratory actions affecting them, then, if the needle of the

galvanometer were fixed, a state of strain would be induced on the passage of the current, and that this strain of the particles would elicit sounds. To test this, a few yards of covered copper wire were passed lengthwise along the flat sides of a small bar magnet, and connected with a battery. On placing the magnet to the ear, sounds were at once detected on making and breaking contact. These sounds were intensified by placing the magnet on the lid of a pasteboard box; or, better still, on a piece of tin. With this simple arrangement conversation, singing, and musical sounds were readily transmitted.

Various forms of receiver on this principle have been devised (see figs. 1, 2, 3, 4, 5), consisting of—

(1) Arrangements of bar magnets, as described, having from 6 to 12 yards of covered wire, and placed in wooden and tin boxes.

(2) A horse-shoe magnet, having a few turns of covered wire passed lengthwise along one of its limbs, and a tin plate placed on their flat sides. With these arrangements talking, singing, &c., were readily transmitted.

(3) A few turns of wire passed round a tin plate, the latter being allowed to rest by attraction on the flat sides of the limbs of the horse-shoe magnet, the tin plate and its wire being placed in various positions. It was found that sounds were transmitted by this arrangement, and that the tone varied with the position of the tin plate. It was also found that pieces of wood or cardboard could be used instead of the tin plate in this experiment.

(4) Interesting results were got by simply taking a tin plate and wrapping a few yards of wire round it (no magnet being used). Sounds were distinguished on breaking contact, and, when connected with the carbon transmitter, musical and other sounds, such as singing, &c., could be heard; talking could just be detected. The sounds were in this case low, but the effects were quite the same as when the magnet was used.

When using a magnet the strongest sounds were observed near its poles; the tone was deeper near the centre.

Square pieces of tin or ferrotype gave fully stronger sounds than round ones. The plates were allowed to lie as close to the magnet as the magnetic attraction induced them, and in some cases were clamped down.

It was found when the magnetic receivers were placed on the edges of a tin box that the sounds were rendered more generally audible.

A single Leclanché cell was used throughout the experiments enumerated.

From the experiments made, the author believes that the sounds originate in the magnet, and that the iron plate, by extending the magnetised surface, reinforces these sounds. Thus, when a large tin plate was placed on the horse-shoe magnet, the vibrations could be detected by hand as a tremor through the metal. Clearness of articulation depended more on the action of the carbon transmitter than upon any nicety of arrangement of the receiver, the latter depending wholly upon the action between the magnetised body and the flow of the current.

The Count du Moncel, in referring to some of the author's experiments in his work on "The Telephone," expresses the opinion that a vibrating diaphragm is not necessary for the reproduction of speech, and that where a diaphragm is used the vibratory movements may arise from the act of magnetisation in the centre of the diaphragm.

From various circumstances the author has been unable to extend his experiments, but he believes that the record of the results obtained will be of interest to the members of the Society, who have so courteously offered him the opportunity of placing them at their disposal.

FIG. 1.

FIG. 2.

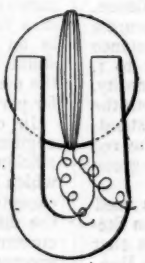


FIG. 3.

FIG. 4.

FIG. 5.

Since reading the paper the author has made some additional experiments upon the mechanical transmission of sound with wires arranged as in some of the recorded experiments, but without any disc or vibrating flat surface at the sending extremity of the line; and it was found that speaking, singing, and musical sounds could be readily transmitted in this manner. In the case of transmission of speech, the speaker spoke to the wire and close to it; the musical instrument, however, was about twelve feet from the wire. It was also found that the ticking of a watch could be very distinctly heard; the watch simply resting on the wire. From these experiments the author believes that a great part at least of the action of strained wires, as used in buildings for the improvement of the acoustics, is explained by the wires picking up the sounds, and transmitting them to other parts of the building, where their motions either become absorbed, or they cease to have much effect upon the air or parts of the building in their vicinity.

TELEGRAPHIC APPARATUS IN USE IN THE BRITISH POSTAL TELEGRAPH DEPARTMENT.

IX.

(Supplement to Article I.)

THE DROP HANDLE SINGLE NEEDLE INSTRUMENT.

AMONGST the English railway companies the use of the "Drop Handle" Single Needle Instrument as a speaking apparatus is universal; in the Postal Service it is also used, but to a limited extent. The extremely small liability of the instrument to get out of order renders it particularly suitable for railway purposes, and many thousands are consequently at present in use.

The apparatus consists of a commutator worked by a drop handle, and a dial like in every respect to those employed with the "Tapper" single needle.

The commutator at present employed is precisely similar in principle and action to the one used when the single needle instrument was first introduced—nearly 40 years ago. That it should have continued so long in use without alteration is a proof of its suitability for the purpose, and, indeed, it would be difficult to imagine a better design for effecting the object in view.

The general principle of the commutator will be seen from fig. 42.

d is a hardwood cylinder, mounted on an axis, *k*, to which is attached the drop handle seen in figs. 43 and 44. Into the cylinder are screwed firmly two short brass rods, *c*, *e*, so that they are insulated from one another; the top rod, *c*, is connected to the battery terminal, Z, and the rod, *e*, to the battery terminal, Y, which latter corresponds to C in the tapper instrument. s_1, s_2 are curved steel springs, fixed upright to the base of the instrument; the upper ends of these springs normally rest against a brass "bridge," *b*, so that metallic connection is made between the two.

The lower ends of the springs are bent up at *g* and *h*, as shown; s_1 is connected with the left-hand bottom terminal of the dial board (which terminal corresponds to B in the tapper instrument), and s_2 is connected to terminal B.

Action of the Commutator.

The action of the apparatus is as follows:—

Supposing the cylinder to have a right-handed angular movement given to it by means of the handle, then the rod, *c*, presses against the spring, s_2, and moves the end of the latter away from the bridge, *b*; the Zinc pole of the battery then becomes connected to s_2, and thence with terminal B and the "Down" line. The Copper pole of the battery, being in connection with the rod, *e*, becomes in communication with the lower part, *g*, of the spring, s_1, and thence through the dial with terminal A and the "Up" line.

If the handle be turned in the reverse direction to the foregoing, then the rod, *c*, presses away the spring, s_1, from the bridge, *b*; thus the Zinc pole of the battery becomes connected through *c* and s_1, and through the dial, with the "Up" line, whilst the Copper pole becomes connected through *e* and *h* with terminal B and the "Down" line; thus the direction of the current becomes reversed.

If, when the handle is at rest in its vertical position, another station sends signals, then the course of the current will be, say, from terminal B through the spring, s_2, the bridge, *b*, the spring, s_1, and thence through the dial to terminal A and the "Up" line.

The connections shown are those for an "Intermediate" station. If the instrument is at an "Up" station, then terminal A must be put to earth, terminal B being connected to line. If the instrument is at a "Down" station, then terminal A must be put to line, and terminal B to earth.

Construction of the Commutator.

As in the "tapper," there are several points which must be attended to in the design of the drop handle instrument, so that it may work with certainty, and without jarring. The arrangement of the various parts may be seen from figs. 43, 44, 45, and 46.

The cylinder to which the rods, *c* and *e*, are screwed is formed of hardwood, covered with a brass cylinder, divided into two halves; into the half near the back of the instrument, the rod, *c*, is screwed, and into the other half the rod, *e*, is similarly secured. A flexible connection is made between *c* and terminal Z, by means of an insulated copper strand wire, *r* (fig. 43); one end of this is secured by a screw to the half of the brass cylinder into which *c* is screwed, the wire then makes a turn loosely round the cylinder and finally is secured to the brass column, *i*, which latter is connected to terminal Z, thus a perfectly flexible and reliable connection, which in no way impedes the regular movement of the cylinder, is secured. The rod, *c*, which is screwed into the second half of the brass cylinder, is connected in a similar way with terminal Y by the strand wire *z* (fig. 44).

The lower ends, *g*, *h*, of the springs, s_1, s_2, against which the rod, *e*, banks when the cylinder is rotated to the right or left, are not solid blocks of metal; if this were the case, every time *e* struck against them a disagreeable jar and rattle would be produced. The actual construction of these portions of the apparatus will be seen from fig. 45, which represents spring, s_2, and its attachments. P, P, is a brass cock which is screwed firmly to the base of the instrument; to one portion of P, the lower end of the spring s_2 (which must be well tempered) is secured. A curved spring, *t*, has one end secured at *x*, and then makes a turn round the lower end of s_2 without touching it, and finally has its other end brought round to the position shown at *h*; between *h* and *x* a block of leather is set which is gripped between *h* and *x* by the pressure of the curved spring *t*; *h* is then the surface against which the rod *e*, strikes when the cylinder is moved, and as the backing is of leather but very little jar is produced. Fig. 45 may seem a somewhat complicated device for producing the required object, but in reality it is a very good way of effecting it. It might be suggested that the spring, *t*, could be dispensed with, and a piece of metal be simply cemented to *w*; this, however, would never do in practice, as no cement would stand the constant jar, and besides it would leave *h* disconnected from P and the spring s_2.

The spring, s_1, and its attachments are of course fashioned in a similar way to the foregoing.

As it is a point of great importance that the rod,

c, should stand clear of the springs, s_1 s_2, when the cylinder is in its normal position, some device is necessary to effect this object, which the weight of the drop handle itself would not do with certainty. Fig. 46 shows how this requirement is effected; the axle of the cylinder nearest the back of the instrument is prolonged through its bearing and is filed square; this square part is gripped between two strong springs, *n*. If now the cylinder be rotated, as shown, then the tendency of the edges of the squared axle is to open the springs, and consequently when the drop handle is released the pressure tends to bring the cylinder back to its normal position.

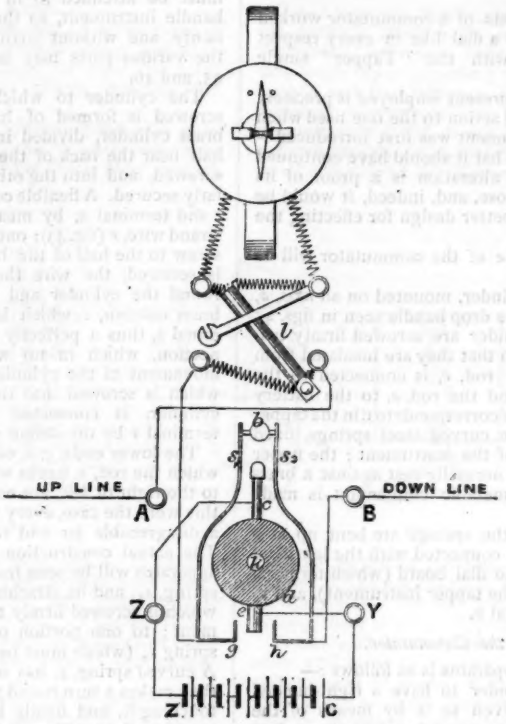


FIG. 42.

The axle to which the drop handle is secured is very firmly fixed, in fact, forms part of the cylinder into which the rod, *e*, is screwed; this is very important, as the violent mechanical action to which the handle is subjected might otherwise cause it to twist out of position.

Faults.

From its solid construction, the drop handle single needle instrument very rarely becomes faulty. The flexible wire connections sometimes break, but from their length and the smallness of the angular movement of the cylinder, this is a very rare fault. The springs, s_1 s_2, are also liable to break, but, again, this very rarely happens. Beyond these two faults, the instrument is practically secure in its action. It is perhaps needless to say, that dirty contacts never occur, the comparatively violent action under which the instrument necessarily works prevents anything of the kind from arising.

SPAGNOLETTI'S SINGLE NEEDLE DIAL.

These dials are largely employed in the railway instruments, and also to some extent in the Postal apparatus. In point of efficiency they are superior to the Varley dial, as with the same current they give much more powerful signals, or equally powerful signals with a less current. A perspective view of the dial with the coils removed is shown by fig. 47. M, M_1 are strong horseshoe magnets with their similar poles turned to one another; the poles are in close proximity to the ends of the axis upon which is fixed the compound soft iron needle, *a*, *b*; this needle is formed in two halves, the upper half being really a prolongation of the right-hand half of the axle, bent at right angles to the latter; similarly the lower half of the needle is a right-angled prolongation of the left-hand half of the axle. The two portions are brazed together, so that the two halves of the axle are in a straight line, whilst the two halves of the needle are similarly in a straight line, but at right angles to the whole axle; a piece of brass, *c*,

FIG. 43.

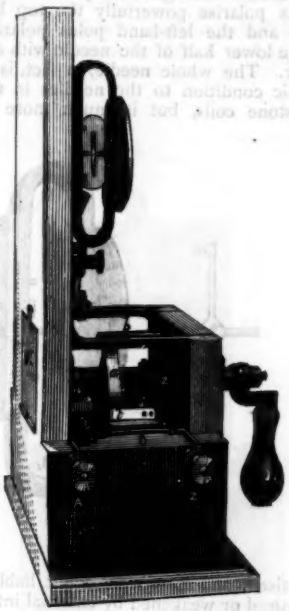


FIG. 44.

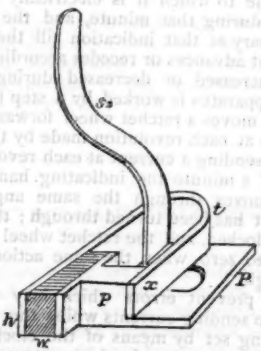


FIG. 45.

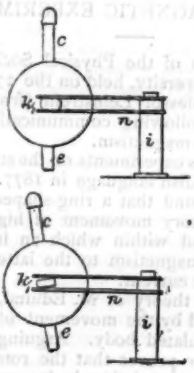


FIG. 46.

between the two elements of the half axles and needles, magnetically insulates the two halves; thus it happens that the right-hand poles of the horseshoe magnets polarise powerfully the top half of the needle, and the left-hand poles polarise powerfully the lower half of the needle with an opposite polarity. The whole needle, in fact, is similar in magnetic condition to the needles in the original Wheatstone coils, but is much more powerfully

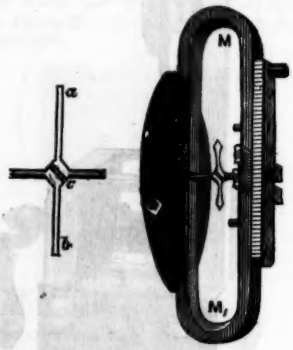


FIG. 47.

magnetised, and moreover is not liable to be demagnetised or weakened by external influences.

The general construction of the coil, viz., its framework, attachment of coils, &c., is similar to that in the Varley coil (article I., page 24).

The instrument indicated by figs. 43, 44, is fitted with a Spagnoletti dial, one of the coils being removed to show the needle.

CURIOUS MAGNETIC EXPERIMENT.

IN the fifth session of the Physical Society of the St. Petersburg University, held on the 27th of December, 1879, Professor Leinstrein (from Gelsinforce) made the following communication on the cause of terrestrial magnetism.

The results of his experiments on the subject were printed in the Swedish language in 1877. In these experiments he found that a ring-shaped insulator which has a rotatory movement of high velocity imparted to it, and within which an iron bar is placed, imparted magnetism to the latter; in fact, acted like a voltaic current.

According to a theory of M. Edlund, this magnetism is explained by the movement of the ether existing in the insulated body. Arguing from this theory, the author proves that the rotation of an iron bar within an insulating body must produce magnetism within the bar. Applying this conclusion to the earth as a paramagnetic body, Professor Leinstrein shows that the earth must be magnetised through its rotation on its axis in the ethereal space, just as is actually the case.

The arterial distribution of the magnetism can be explained through the earth's movement around the sun.

Magnetic perturbations have their origin, in the the opinion of the author, in the electric currents which are originated in the aurora borealis.

AN ELECTRICAL SPEED INDICATOR.*

By H. R. KEMPE.

THE design of a Speed Indicator has often been attempted by various mechanicians, and many ingenious devices have been the result. One of the simplest forms of apparatus for the purpose is constructed on the principle of the governor of a steam engine, in which the angular deviation of the weighted arms represents the speed at which the instrument is turning. Such an instrument has been designed by Messrs. Elliott Brothers. Another form of instrument consists of a vertical glass tube partly filled with oil or coloured liquid, and which is rotated on its axis; the action causes the liquid to rise in the tube, the height to which it ascends representing the velocity.

The scales for such instruments are graduated by trial, and are not always correct under all conditions, as they are dependent to some extent upon variable quantities. It is also necessary that the indications be read at the place where the speed to be measured takes place.

In the instrument which I have to show you this evening the indications given are absolutely accurate under all conditions, as the apparatus is regulated by means of a clock, and, moreover, the instrument can be placed at any distance from the engine or apparatus whose speed it is required to indicate.

It would be impossible without elaborate diagrams to explain the action of the apparatus, but I will point out that the indicating hand points at every minute to the number of revolutions which the machine to which it is electrically connected has made during that minute, and the hand remains stationary at that indication till the next minute, when it advances or recedes according as the speed has increased or decreased during that minute. The apparatus is worked by a step by step motion, which moves a ratchet wheel forward one tooth at a time at each revolution made by the engine, the latter sending a current at each revolution. At the end of a minute the indicating hand is unlocked, and moves through the same angle which the ratchet has been turned through; the hand is then again locked, and the ratchet wheel allowed to run back to zero, when the same action is again gone through.

To prevent errors which may arise from the engine sending currents whilst the indicating hand is being set by means of the clock, an "accumulator" is employed which accumulates all the currents received from the engine during the time the clock is setting the hand; and then, when the latter action is completed and the rachet wheel returned to zero, the amount accumulated is given

* Read before the Society of Telegraph Engineers, May 12th.

off. By this device, it happens that the sum of all the indications observed on the dial at each minute, during a number of minutes, will always equal the total number of revolutions given by the engine during that number of minutes.

By fixing a small grooved wheel on the axle of the indicating hand with a cord round it to which a pencil is attached, a record can be made of the speed. The size of the sheet of paper on which the indications are drawn can be made without difficulty of convenient dimensions. It need not exceed a size of about two feet by one foot, for indications given during twenty-four hours. On this diagram a line will be traced which will be straight if the engine is working uniformly, and wavy if the speed is irregular, the amount of the deviation showing at once the rate of increase or decrease in the speed.

The uses to which the apparatus, which is shown in front and back view by figs. 1 and 2, can be applied, are obviously numerous. It can be used for indicating the rate at which the paying-out drum of a cable ship is turning, the indicator being placed in the engineer's cabin; the rate at which the ship's engines are working can similarly be indicated.

FIG. 1.

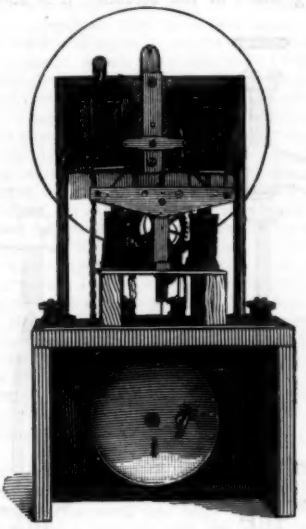


FIG. 2.

NEW ELECTRIC LAMPS FOR TEMPORARY PURPOSES.

THESE small arc lamps are distinguished from other regulators of the same description by the means employed to obtain constant equilibrium by the action of a solenoid and an antagonistic spring.

This equilibrium is obtained by means of a new arrangement invented by M. Emile Reynier, of which the following is a description:—

Let us suppose a bar of soft iron to be completely surrounded by a vertical solenoid, and magnetised by a current of constant strength, and let us progressively cause the iron bar to slide up, for example, in the axis of the system, then the attractive force which hinders the movement of the soft iron bar increases continually until a certain position is reached at which the magnetic attraction is a maximum. If the movement be continued beyond this point the attractive force diminishes, and at length becomes nil, when the bar is completely withdrawn from the coil.

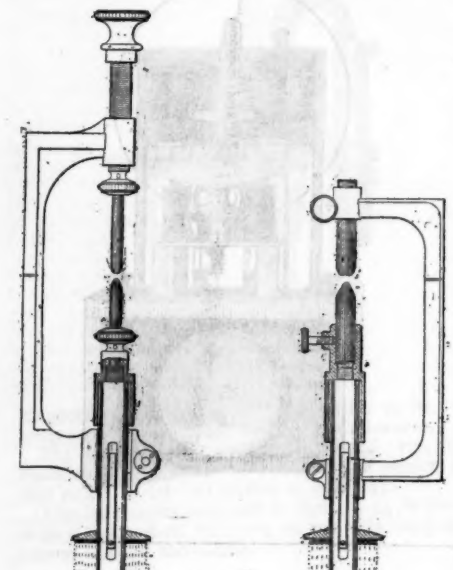
The diagram which would be obtained by taking for abscissæ the distances moved over by the bar, and for ordinates, the magnetic attractions, would form a curve which commences from a point situated above the axis of X, and which rises to a maximum corresponding to the approach of the lower end of

the bar towards the end of the solenoid, and re-descending from the maximum down to the axis of the abscissæ.

We will only consider here this descending part of the diagram. We observe immediately that it forms very nearly a straight line which joins its two extremities.

Now a straight line inclined to the axis of X is precisely the diagram of a spiral stretched spring.

In order to obtain a spring, of which the diagram of tension corresponds to the diagram of the descending curve of the solenoid, it is sufficient to



take a spiral which is pulled to a tension equal in power to the magnetic attraction of the solenoid in question, and which has a length equal to the length of traverse of the bar through the solenoid corresponding to the positions of maximum and minimum attraction.

Such a spring being placed around the soft iron bar, and held at its lower extremity, at a particular point, forms a system possessing the following properties :—

1st. When the current which magnetises the solenoid has a normal intensity, the spring produces equilibrium with the magnetic attraction which sucks in the soft iron bar, so that the position of the latter is above that of the region of maximum attraction.

2nd. When the current is of a less intensity the spring overcomes the magnetic attraction and pushes the soft iron bar upwards to the equilibrium position.

3rd. When the current is of a greater intensity the magnetic attraction overpowers the spring, and sucks in the iron bar downwards to the equilibrium position.

A solenoid, a soft iron bar, and a spring, combined under the conditions which we have just indicated, constitute the essential part of two lamps which have been devised by M. Reynier, and which differ slightly the one from the other. The lower carbon holder of each lamp is fixed upon a soft iron rod, and partakes of its movements; the upper carbon holder is fixed, and is attached to the body of the solenoid by an angle piece.

When the current flows through the apparatus, the iron is sucked in downwards in the solenoid, and descends so that the arc is formed to its normal length. In proportion as the carbons are consumed, the iron bar rises in equal proportion and preserves the arc of a uniform length.

The spring being constructed for a given intensity of current, if the lamp is employed with a current of a different strength, the diagram of the spring will not coincide with the curve of the solenoid's attraction; it will fall below or above. It is possible to reform this diagram to an approximate coincidence by altering its origin. This can be done by stretching the spring by means of a thumb screw at the base of the instrument. This readjustment cannot be employed except within small limits. The lamp works badly with currents of an intensity very different from that for which the spring is constructed.

One form of these lamps is for temporary use in the place of an ordinary regulator. By means of an accessory provision this temporary lamp may be made automatic in its action, immediately that the principal regulator fails from the carbon being consumed, and it will work for twenty minutes, during which time the light will not be interrupted.

A number of these lamps have been in use at various places, for different purposes, since last winter, and have given perfect satisfaction.

The other form of lamp is a model specially adapted for laboratory purposes for throwing objects on the screen; it is constructed for carbons of small diameter, and its bobbin is wound with thinner wire, for currents of a moderate intensity.

The lower carbon being alone movable, the luminous point continually shifts its position. By means of a little movement which can be given from time to time to the upper carbon, the light can be set to a convenient height.

During the burning, the lower carbon holder works automatically in such a way as to maintain the length of the arc constant. The total traverse of the apparatus is equal to three quarters of an hour's burning.

Less complete than the regulators of Duboscq and Serrin, but much less costly, this little lamp answers well for most optical experiments.

A. NIAUDET.

Notes.

MR. J. BERLY, of the "Société Générale de l'Electricité," has continued his experiments in electric lighting on long circuits, and has joined up the two circuits at Victoria Station with that at Blackfriars, making a total circuit of nine miles. Also he has tried five candles joined up with No. 18 wire; these, when compared with a precisely similar five on No. 12 wire, gave equally good results.

IT is stated that the break in the cable of the new French Company is ascertained to be in shallow water about eight miles from St. Pierre, and that the *Pouyer-Quertier* will sail this day week to effect the necessary repairs, which it is expected may be done at once.

THE BRUSH ELECTRIC LIGHT has recently been introduced in the South Kensington Museum.

THE HELIOGRAPH.—We have to thank the heliograph again for an important message received from General Stewart, and announcing the result of an attack on our troops, in which the enemy seems to have suffered severely. The message is dated Camp Ghuzni, April 22nd, and was received at the India Office the following day. It is very probable that the news could not have been brought so speedily by electric telegraph. The heliograph does not require the route to be kept open. The line of communication cannot be cut, for the simple reason that the signalling takes place over the heads of the enemy, and the stations required are but few and far between. A 10-inch mirror, and this is the diameter of the ordinary field heliograph, is capable of reflecting the sun's rays in the form of a bright spot, or flare, to a distance of 50 miles, the signal at this interval being recognisable without the aid of a glass. That is to say, two trained sappers, each provided with a mirror, can readily speak to one another, supposing the sun is shining, with an interval of 50 miles between them, provided their stations are sufficiently high and no rising ground intervenes to stop the rays. The adjustment of the military heliograph is a very simple matter. An army leaves its base where a heliograph station is located, and after travelling some miles desires to communicate with the stay-at-homes. A hill in the locality is chosen, and a sapper ascends with his heliograph, which is simply a stand bearing a mirror swung like the ordinary toilet looking-glass, except that besides swinging horizontally it is also pivoted so as to move vertically as well. Behind the mirror, in the very centre, a little of the quicksilver has been removed, so that the sapper can go behind his instrument and look through a tiny hole in it towards the station he desires to signal. Having sighted the station by adjusting the mirror, he next proceeds to set up in front of the heliograph a rod, and upon this rod is a movable stud. This stud is manipulated like the foresight of a rifle, and the sapper again standing behind his instrument directs the adjustment of this stud until the hole in the mirror, the stud, and the distant station are in a line. The heliograph is then ready to work, and in order to flash signals so that they may be seen at a distance the sapper has only to take care that his mirror reflects the sunshine on the stud just in front of him.—*Daily News.*

THE Brush light, an American invention employing the voltaic arc, is a wonderful success, and bids fair to throw the Jablochkoff candle and all other European contrivances into the shade. It is remarkable that the more successful an electric light is the less public parade it makes; and the Brush lamp has gone into use so quietly that very few are aware of the facts of the matter. About 1,500 of them are now in use. A large number of letters have been received by the writer from cotton-mill and factory owners in this part of the country, in reply to private inquiries as to their experience with the electric light. From these replies, it does not appear that the voltaic arc is always a cheaper means of illumination than gas, but sometimes it is remarkably so. The Pottstown Iron Company report that they have been enabled to run their nail factory all night by means of this light, being the first concern which ever did this. They never could get light enough in their dingy shops at any reasonable cost, but the voltaic arc is ample for the purpose. They do not know what the light costs them, and do not care. Mr. John Wannemacher has just invested about 13,220 dols. in engines, electric machines, and Brush lamps, and he reports that allowing 12 per cent. interest on the investment, and 5 per cent. for wear and tear, he saves 69 per cent. on his bills for lighting. I have received one statement from a large cotton factory in Rhode Island which has been using the voltaic arc light since February, 1876, which is almost incredible. The concern has invested 16,000 dols. in generators and lamps, using 80 lamps in place of about 500 gas-lights. It finds that it now gets a vast increase of light at a cost of only 8,260 dols. a year, whereas it formerly paid out over 28,000 dols. a year for gas. This concern runs all night, and says that the men would not on any account go back to gas-light, because the air of the mill is so much better.—*N. Y. Correspondent Chicago Tribune.*

NEW CABLES.—Duplicate cables have been laid between Singapore and Java, and between Java and Port Darwin. The work has been carried out under the guarantee of a subsidy from the colonies of New South Wales and Victoria, which will make arrangements with the other colonies. In return for the subsidy, Government and press messages are to be carried at reduced rates.

THE use of the electric light on ship-board, both as a means of interior illumination and for the prevention of accidents at night and during foggy weather, is steadily on the increase. The Sound Steamers *Massachusetts* and *Rhode Island*, of the Providence line, have recently been fitted up with Brush lights, by which the halls, cabins, and dining saloons are lighted by electricity. The contract includes an electric head-light, which it is expected will prove extremely valuable in foggy and stormy weather. An exhibition of the use of the new light was given last week on board the steamer *Massachusetts*. Six lights were used, each light being nominally of 2,000 candle-power, and although the saloons were nearly as brilliant as in the day-time, the light was soft and pleasant to the eye. The comparative cost of this light is about equal to that of gas at 30 cents per 1,000 feet.—*Operator.*

WRITING to *Nature* on the subject of Dr. Kerr's discovery of the rotation of the plane of polarisation of light reflected from the pole of a magnet, Mr. J. E. H. Gordon points out how extremely feeble the phenomenon is.

"I used," he says, "an electro-magnet consisting of an iron bar 2 feet 4 inches long, and 2¼ inches diameter, surrounded by 70 lbs. of wire, and excited by 10 Grove cells. The total *double* rotation produced

not by slightly altering the resistance, but by reversing the current, was never more than 26′ (26 minutes of arc). To see this at all with a very delicate Jellett analyser, it was necessary for the observer to increase the sensitiveness of his eye by sitting in total darkness for some 10 minutes before each observation."

THE ELECTRIC LIGHT IN NAVAL WARFARE.—The *Gibraltar Chronicle* of the 5th ult. says:—"On Saturday night at 9.30 o'clock, to the great astonishment of those who were not prepared for it, but who happened to be looking towards the bay, a brilliant light was seen to burst forth suddenly, shooting out a prolonged ray across the water and on to the Rock, which it lighted up in a most vivid manner. This was soon followed by a second similar light at some little distance from the first, and it soon became evident that they were electric lights and proceeded from her Majesty's ships *Minotaur* and *Agincourt*. The practice that followed with these lights, and which was continued for nearly an hour, was interesting in the extreme, for there was not a hole or cranny on the western face of the Rock from the water to the signal station that was not searched out and illuminated as if by magic; nor was there a vessel or a boat in the bay that did not undergo the same minute examination. Owing to the concentration of the light at the instrument necessary to permit of its rays being reflected to a distance, the sphere of its action is unavoidably limited, and it hence becomes necessary to search the water or the shore gradually and methodically, in such a manner as to insure no spot being left unlighted. Thus the drill in itself is intricate, and requires considerable practice. There is one point which cannot fail to strike even the uninitiated, which is that during such time as a vessel displays the electric light she is, while illuminating the batteries of her opponents, an excellent mark for their guns."

THE electrical observations taken at the Mount-souris Observatory in the last week in April showed some unusual results; out of the eight readings registered on April 28th not less than six were negative, and on the following day seven were of the same sign.

THE shares of the Edison Electric Light Company, par value 100 dols., which at one time sold at 5,000 dols., have since fallen to 1,700 dols. It is stated that many of the extraordinary statements published in regard to the electric light were made solely with a view of enhancing the value of these shares.

THE *Natural History Journal* publishes an account of a method of producing facsimiles of plaster-casts in electrolytic copper. The cast is first boiled in stearine, and then blackleaded over; it is then placed in a sulphate of copper bath, and connected to a very weak battery, so that a thin but firm coating of copper is deposited all over the surface. The cast is next baked so as to destroy the cohesion of the plaster particles, which are shaken out in the form of dust, leaving only the copper coating as a shell, the latter is then varnished outside, and again placed in a copper depositing bath, and thickly coated with copper inside, thus solidity is obtained, the outside surface of the shell retaining its sharpness of outline.

THE Electrotechnical Society at Berlin now numbers 1,248 members.

EDISON'S HORSESHOE LAMPS.—Messrs. Henry Morton, A. M. Mayer, and B. F. Thomas, who recently published in the *Scientific American* an account of some electrical measurements of one of Mr. Edison's horse-shoe lamps, and which we reprinted in our last issue, have since published the following additions and corrections to their past article:—

"In reading our first article in print we notice some errors which require correction and some points calling for a more full explanation.

"It was said in the article that the *loss* of weight in one of the electrodes was 1·0624 grammes.

"This was in fact the amount *gained* by the cathode, the loss of the anode being a trifler greater. The gain of weight was, of course, what it was intended to take, so that the error was only in the expression, and not in the process or result.

"In the next place, in the foot note at the end of the same column, it is simply stated that the average of the maximum and minimum lights in azimuths at right angles and in the plane of the loop was taken as the average luminous power of the lamp. Our reason for this, however, was not mentioned, but was, in fact, that we found by measuring the light at every azimuth varying by ten degrees between 0° and 180°, that this was approximately the true expression for the total amount of light emitted. We see from the article of Profs. Rowland and Barker, in the *American Journal of Science*, that they, assuming certain conditions and discussing the same in a mathematical manner, have reached a different result; but as experiment shows this result not to be attained in fact, it is evident that the assumptions on which the mathematical reasoning is based do not include all the conditions present in the experiment.

"Two other sets of experiments, made since those given in our paper of April 17, in which the candle-power of the loop was in its best position, 17·6 and 19·8 candles, corresponding to averages of 11·7 and 13·2 candles respectively, showed a consumption of energy of 0·104 and 0·109 horse-power per lamp, or 9·6 and 9·1 lamps per horse-power. This would give 112 candles and 120 candles respectively per horse-power of electric energy consumed or transformed in the lamp. These results certainly agree very closely with each other and with our former determinations."

A PUBLIC company, with a capital of 8,000,000 francs, has been formed to work the patent of M. Jamin's electric lamp.

THE French Minister of Fine Arts has entered into an agreement with the Jablochkoff Electric Light Company to light the palace during the whole of the two months, commencing May 1st, devoted to the exhibition. The number of lights is about 400, and the motive power about 320 horses. Owing to an accident to the machinery, the use of the system had to be suspended for a few days.

ELECTRICITY IN THE HUMAN BODY.—The attention of scientific men has been occasionally directed to the question of the existence of electricity in the human body, and of the capacity of man and other animals to become a store-house, as it were, of electric force; but the subject has not yet been properly investigated, and any new facts bearing on the point are valuable. The matter is one which is of practical importance, in view of the attempts which are being made to press electricity into the service of the medical world as a curative agent. Most people are familiar with the "sparks" which may be produced under certain conditions, by stroking the fur of a cat; and travellers in Canada and other cold dry countries have witnessed the still more remarkable phenomenon of the human body being turned into a conductor of electricity, and the possibility of lighting the gas by merely placing

one's finger—given the necessary conditions of electrical excitement—near the gas-jet without any other agency. Mr. A. W. Mitchinson, the African traveller, who is engaged in writing a narrative of his exploring expeditions in West Central Africa, gives some still more startling facts. He states that one evening, when striking an African native, in a moment of anger, with a cow-hide whip, he was astonished to see sparks produced, and still more surprised to find the natives themselves were quite accustomed to the phenomenon. He subsequently found that a very light touch, repeated several times, under certain conditions of bodily excitement, and in certain states of the atmosphere, would produce a succession of sparks from the bodies of native men as well as native cattle. A lazy nigger, it seems, yielded none of these signs of electricity—a rather unfortunate circumstance for his more active brethren, who may possibly come in for a share of undeserved flogging at the hands of future travellers in search of electrical phenomena among the human race. We are not aware that these facts have been recorded by other travellers, but they certainly deserve thorough sifting by competent observers.—*Globe*.

THE King of Spain has signed a decree authorising the laying of a cable between Cuba and Jamaica.

IN magnetising steel bars by means of a coil, M. Righi finds that on taking both bars of the same steel and the same diameter, and decreasing their length, a certain length is arrived at which no longer yields any magnetisation; whilst smaller lengths give a permanent polarity opposed to that of the coil.

THE cable between Cadiz and the Canary Islands will shortly be sold.

THE following notice has appeared in the columns of the daily press:—"Sivewright—Page.—April 27, at St. Andrew's Cathedral, Bloemfontein, South Africa, by the Very Rev. Archdeacon Croghan, assisted by the Rev. Canon Miles, James Sivewright, Esq., M.A., C.M.G., general manager of telegraphs, to Jeannie, third daughter of George Page, Esq., of Bloemfontein."

SYSTEMS of electric fire-alarms are now being fixed in various parts of the City.

WE have received a copy of a book containing meteorological observations made at the Adelaide Observatory during the year 1878. It is produced under the able direction of Mr. Charles Todd, C.M.G., F.R.A.S., superintendent of telegraphs, South Australia, and is published by the authority of the South Australian Government. The information contained in this work must necessarily prove of great value to those interested in the study of meteorology.

Correspondence.

To the Editor of THE TELEGRAPHIC JOURNAL.

DEAR SIR,—Kindly allow me to point out an error in your remark on my note on "measurements of quantities of current by the craters of positive carbons," brought before the Society of Telegraph Engineers by Professor Ayrton at the last meeting.

The first column of the table in your last week's issue should be headed "Diameter of Craters in inches," instead of "Depths of Craters in inches."

I am, dear sir,
Yours faithfully,
J. W. F. ANDREWS.

5, Mount Street, Margon Road,
Near Charlton, Kent.

Proceedings of Societies.

PHYSICAL SOCIETY.—MAY 8th.

SIR WILLIAM THOMSON, President, in the Chair.

New members—E. F. BAMHER, Dr. E. OBACH, R. D. TURNER, E. WOODS, H. E. ROSCOE, H. WATTS.

Prof. MINCHIN, of Cooper's Hill Engineering College, described his further researches in the subject of photo-electricity, brought by him before the last meeting of the Society. He has found that the current in a sensitive silver cell does not always flow from the uncoated to the coated plate. It does when chloride or bromide of silver is used, but when the sensitive emulsion is iodide of silver, and the liquid water tinctured with iodide of potash, the current is from the coated to the uncoated plate. He demonstrated that the current set up by the fall of light on the cell could be sent by wire to a receiving cell, and made to produce a *local* effect on the sensitive plate therein. He also proved that electricity is developed in fluorescent bodies by the action of light, and hopes to show that it is also developed in phosphorescent bodies. Neither heat nor the red rays produce this electricity, but it is the blue and violet rays which do so. The fluorescent silver plates he employed were coated with an emulsion of eocine and gelatine, and kept sensitive for twelve days. They would thus be a permanent source of photo-electricity, did the eocine not tend to leave the gelatine. Mr. Wilson had suggested napthaline red for eocine, as not apt to leave the gelatine, and he had found it give good results.

Dr. O. S. LODGE described certain improvements which he had made in his electrometer key, designed for delicate electrical, and especially electro-static, experiments. Assisted by the British Association, he had made it more convenient, and fitted it into an air-tight case, which could be artificially dried. The contact pins were now of phosphor bronze, gilt, instead of platinum, and the contacts were made by press pins from the outside. Dr. LODGE also exhibited a new inductometer, or modified form of Prof. Hughes' induction balance, combining a Wheatstone balance, and expressly designed for comparing capacities and resistances, especially the resistances of coils having no self-induction. A telephone takes the place of a galvanometer in the bridge, and the current in the primary coil is interrupted by a clockwork make and break. There is one primary coil of fine wire, 3¼ ohms in resistance, and two secondaries, one on each side of it, of fine wire, each about 270 ohms. These are fixed, but the primary is adjustable by a screw. Prof. HUGHES remarked that he had pointed out in his paper to the Royal Society that the induction balance could be used in this way; and Dr. Lodge disclaimed any novelty in the apparatus beyond its arrangement. Sir W. THOMSON added that it was satisfactory to see so serviceable an adaptation of the induction balance to research.

Dr. HOPKINSON, Prof. PERRY, and Sir W. THOMSON offered remarks on the element of time in comparing

discharges from condensers of different dielectrics. Sir WILLIAM said that in 1864 he had made experiments on air and glass dielectrics and found the discharge about the same for the first $\frac{1}{4}$ sec. Prof. ADAMS then took the chair, and Sir W. THOMSON made a communication on the elimination of air from a water steam presssure thermometer, and on the construction of a water steam pressure thermometer. He said it was a mistake to suppose that air was expelled by boiling water because the water dissolved less air when warm than when cold. The fact was due to the relations between the density of air in water, and the density of air in water vapour. There was 50 times more air in the water vapour over water in a sealed tube than in the water below. If this air could be suddenly expelled only $\frac{1}{50}$ part of air would remain, and of this only $\frac{1}{2500}$ in the water, the rest being in the vapour. This suggested a means of eliminating air from water which he had employed with success. It consisted in boiling the water in a tube, and by means of a fluid mercury valve allowing a puff of the vapour to escape at intervals. Sir W. THOMSON also described his proposed new water steam thermometer, now being made by Mr. Casella. It is based on the relations of temperature and pressure in water steam, as furnished by Regnault's or other tables, and will consist of a glass tube with two terminal bulbs like a cryophorus, part containing water, part water steam, and the stem enclosed in a jacket of ice cold water. Similar vapour thermometers will be formed in which sulphurous acid and mercury will be used in place of water or in conjunction with it. For low or ordinary temperatures they will be more accurate than ordinary thermometers.

THE SOCIETY OF TELEGRAPH ENGINEERS.

THE ordinary general meeting of this Society was held on Wednesday, May 12th, Mr. W. H. PREECE, President, in the chair. The minutes of the last general meeting having been read and confirmed, and the list of new and proposed members read, it was announced that the catalogue of the Ronald's library had been completed, and was ready for publication.

Mr. W. H. PREECE then read a paper on "The Destruction by Insects of Gutta-percha in Underground Wires."

For some years past a peculiar decay has been noticed in some of the underground gutta-percha work of the Postal Telegraph Department, which had been difficult to account for. Gutta-percha, as is well known, is a gum exuded from a tree found in tropical climates, called, Isonambra percha. The constituent compounds of gutta-percha are carbon and hydrogen, there being 88 per cent. of the former to 12 per cent. of the latter. It is very seldom, however, that the substance is found pure; oxygen and resins of various natures exist in it as impurities, and the process by which it is sought to purify the gum has the effect of adding other impurities. The chemical composition of the material is the same as that of oil of turpentine.

The discovery of gutta-percha was made about 38 years ago, between the years 1842 and 1843. Dr. Montgomery, when out on one of the islands of the Indian Archipelago, noticed a native with an axe which had a handle of a dark brown flexible material, and he found that the substance could be softened and moulded by the action of hot water. Samples of the substance were brought over to Berlin, and subsequently Faraday examined it, and discovered its high electrical and insulating properties.

As regards durability, the gum was soluble in various liquids, such as, olive oil, benzine, turpentine, &c. It was attacked by ozone, creosote, and other substances. Oxygen also attacked it by a process of rusting, and intermittent exposure to wet and dry rapidly disintegrated and perished the substance. The process of manufacture of the gum caused it to absorb water.

To get rid of the liability of the substance to become perished when applied to insulate wires, Mr. Edwin Clark covered the material with tarred tape, but inasmuch as tar contains creosote, the result was only partially successful.

In 1852, 1853, and 1854, large quantities of wire insulated with gutta-percha were laid down, and as some miles of this deteriorated in various places the subject was investigated by Mr. Edward Highton. This gentleman found that in the underground line between London and Manchester the gutta-percha became decayed wherever the line passed near the roots of oak trees, and he found at such points the surface of the material was covered by a fungoid growth, to which he attributed the mischief; in this surmise, however, he was incorrect.

In all systems of gutta-percha work it is found that where decay takes place, it is at points where air and moisture combined can penetrate, and where changes of temperature take place; this is the case at "flush boxes," and therefore at the present time these boxes are as far as possible hermitically sealed.

Lightning was very destructive of underground work, but this is now prevented by placing lightning protectors at the points where the open work and underground work join. Rats and mice were also very destructive to gutta-percha wires.

The cause of deterioration to which Mr. PREECE particularly desired to draw attention, was that caused by an insect. It was found that the underground work between Chester and Holyhead was in a peculiar state of decay, and on opening up the line and examining the gutta-percha it was seen that the surface was covered with a number of white insects, to which the name of Tempeltonia crystallina had been given. The animal was very small and belonged to the spring-tailed tribe; it was clearly traced that these insects had eaten the substance of the gutta-percha, indeed, microscopical examination proved that the stomach of the insects contained that material.

To get rid of this source of decay, the only course was to entirely bury the wires in hermitically sealed pipes.

Specimens of the insect were exhibited under microscopes.

In the discussion which followed the reading of the paper,

Mr. DAVID BROOKS said, that the amount of gutta-percha insulated wire manufactured in America was very inconsiderable, most of that used being procured from England. Wire insulated with kerite was used to some extent, and with success.

Mr. BROOKS afterwards described his system of underground work, a full description of which has been given in the number of this Journal for Dec. 1st, 1879. Mr. BROOKS stated that when a large number of wires were used for telephonic purposes all bunched together, the effect of induction was very small if all the wires were in use—that is to say, if they all had earth connections. He said that if a number of wires existed in a cable, and only two were in use, the others having their ends insulated, then the induction between the two wires in use was very powerful; but as each of the other wires was put to earth, either direct or through other telephone instruments, the effect of the induction at once became reduced.

Mr. TRUMAN considered that the insect which destroyed the gutta-percha did not exist because the gum

was present, but because it was laid in localities where the vegetable matter around was favourable to the existence of the species. He stated that as regards deterioration by climatic causes, &c., he had completely discovered the cause and remedy, but was not prepared at the time to publicly announce them. Everything depended upon the process of manufacture.

Mr. LATIMER CLARK could corroborate the statement that the decay was due to an insect. As regards general deterioration, this was entirely prevented by keeping the gutta-percha immersed in water, and in tropical countries, where cables landed the leading-in portion of the cable was brought through a pipe which was kept constantly filled with water from a small reservoir, this completely preserved the gutta-percha. He had himself attempted to arrest the progress of decay in gutta-percha wires, using tarred and painted tape, but the success obtained was only partial.

Mr. FLEETWOOD stated that it was quite a mistake to suppose that the faults in the underground work of the Metropolitan district were due to joints. In the last three years he had not had ten cases of faults due to this cause; the decay was solely due to action of air and moisture at the flush boxes. Faults in joints were caused by the use of Chatterton's compound; since the use of this had been discontinued the joints seldom, if ever, went bad. By packing and cementing the flush boxes, and clothing the wires at those points with canvas, the deterioration was prevented. He considered that the real cure for the evil was to entirely bury the wires. It was very necessary that the gutta-percha be of good quality. He had known the old material to last for sixteen years, and at the end of that time to be as good as new. Wires buried in clay soil were especially good, but in gravel they deteriorated if not entirely protected.

Mr. BELL said that the effect of tarred tape on gutta-percha wires was to reduce their insulation over 20 per cent. He had tried paraffin wax instead of tar, but the substance was too brittle. Ozokerit gave better results, and improved the insulation. The tape was saturated with the hot material, and when cold was wound on the gutta-percha wire.

Professor AYRTON drew attention to the fact that the new lines of underground work in Germany were in many places bricked and cemented in, so as to obtain complete protection.

The PRESIDENT, in conclusion, amongst other general remarks, stated that some years ago he had had a number of defective gutta-percha wires placed in a trough in a tunnel, and filled with a mixture of tar and pitch; these wires had lasted for fifteen years without failure, being quite perfect at the end of that time.

Mr. KEMPE then gave a description of his "Speed Indicator," an account of which will be found on page 175 of the present number of this Journal.

A paper by Mr. J. WILLMOT was then read, on "A New Form of Wheatstone Automatic Receiver." This instrument, which is specially adapted for high speed working, is driven by a weight, and is so arranged that the principal part of the mechanism can be detached with great ease from the driving weight without interfering with the latter. The axle of the wheel carrying the driving weight is connected with the axle of the principal wheel of the clockwork mechanism, by a bayonet joint, which prevents the separation of the two except in a certain position. When it is required to detach the two, a pawl is allowed to drop into the teeth of a wheel on the weight axle, which locks the latter, so that if the two axles are separated the weight cannot fall. When the separation is effected it is impossible to release the pawl, owing to the teeth of the wheel being undercut; the withdrawal can only be effected by the wheel being turned back by a handle.

The release of the two axles from the bayonet joint coupling takes place when a tooth of the ratchet wheel has come up to the hook of the pawl and becomes hitched; the momentum of the clockwork axle for the running of the wheels of the latter twists the bayonet joint to the position in which the two parts can be separated. The device is very useful, as it enables repairs to the parts of the mechanism liable to injury to be easily effected, it not being necessary to send to the workshops the rougher and heavier parts of the apparatus.

The speed at which the new form of instrument can be run at is 200 words a minute. The instrument, which was a model of constructive finish, was manufactured by Mr. Stroh.

It having been announced that Dr. Siemens' paper on "The use of the Dynamo-Electric Machine in Horticulture and in Metallurgy," which had been postponed on account of the indisposition of the author, would be read on a special night, and that the next paper read would be by Mr. Edward Graves, on "The Progress of Telegraphy," the meeting adjourned.

New Patents—1880.

1720. "Improvements in, and appertaining to, the attachment of telegraph and other electric conducting wires to insulators." J. R. EDWARDS. Dated April 27.

1738. "Permanent and electro-magnets, and electric telephones, and telephone circuits." W. R. LAKE. Dated May 4.

1751. "Electric signal apparatus for railroads." W. MORGAN-BROWN. (Complete.) Dated April 29.

1764. "Telephones." R. and M. THEILER. Dated April 30.

1820. "An improved apparatus for preventing collisions on railways." H. J. ALLISON. (Communicated by H. Bagilet.) Dated May 4.

1824. "Electric telegraphs." R. C. ANDERSON. Dated May 4.

1826. "Electric lighting." J. E. H. GORDON. Dated May 4.

1828. "Improvements in clocks, or time-keepers, and in apparatus for operating and controlling a series of the same by the aid of pneumatic pressure and electricity." W. R. LAKE. (A communication by the Compagnie Générale des Horologes Pneumatiques.) Dated May 4.

1840. "Apparatus for the production of electric light." W. R. LAKE. (Communicated by S. L. Clingman.) Dated May 5.

1907. "Railway signal apparatus." W. R. SYKES. Dated May 10.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1879.

3659. "Apparatus and fuzes for electrical firing." SAMUEL JOSEPH MACKIE. Dated Sept. 13. 6d. Consists in using a leading wire to each electrical fuze in a series, and making a break in either the leading or return wire, and bridging the same by means of a movable contact maker.

3679. "Insulators." G. F. REDFERN. (A communication from J. H. Bloomfield, of Concordia, Entre Rios.) Dated Sept. 13. 6d. Consists of insulators

designed to be made of glass, porcelain, or glazed brown ware, with a convexed upper end, a concaved lower end, and two downwardly projecting cup-flanges around its upper part, covering the part around which the wire is to be fastened.

3697. "Electric lamps, or regulators." ALEXANDER M. CLARK. (A communication from J. M. Anatole Gérard Lescuyer.) Dated Sept. 15. 1s. Describes electric lamps, similar in principle to those of Mr. Hickley, described in TELEGRAPHIC JOURNAL, No. 163, and those of Mr. Wilde and Mr. John Rapieff, in No. 144.

3728. "Electric railway signals." THEODORE AL BURTIS PUTNAM. Dated Sept. 17. 4d. Consists generally in a system and appliances whereby a moving locomotive or train of cars at different times forms automatically a part of several electric circuits, by closing the same to operate an alarm placed on such locomotive or train. (*Provisional only.*)

3750. "Electric lamps." H. J. HADDAN. (A communication from C. F. Brush.) Dated Sept. 18. 8d. Consists of a double form of Brush lamp (see TELEGRAPHIC JOURNAL, p. 21, vol. vii.), and various modifications of same, and also of an automatic shunt or cut off.

3771. "Electric lamps." JAMES BROCKIE. Dated Sept. 19. 6d. This describes the Brockie lamp, illustrated on page 114, vol. viii., with some variations.

3777. "Electric pens." THEOPHILUS COAD. Dated Sept. 19. 2d. Consists in the application of a crane, suitably fixed with a pillar and arm, preferably formed hollow, for suspending and balancing the pen, so as to obviate the difficulty of maintaining puncturing pens in a perpendicular position, owing to the top weight of the apparatus. (*Provisional only.*)

3793. "Apparatus and application thereof for producing and subdividing the electric light." JOHN HARROP. Dated Sept. 20. 2d. Relates to improvements in the method of conducting the electric currents to and from the carbon points, used as the media for producing the electric light. (*Provisional only.*)

3794. "Apparatus employed in connection with telephones." ARNOLD WHITE. (A communication from Thomas Alva Edison.) Dated Sept. 20. 6d. Relates to improvements in the methods by which two separate electric circuits may be quickly united to form one, and as quickly divided so as to again constitute two distinct circuits. And further to electric annunciators, and also to an electric connecting board in combination therewith for telephonic exchange purposes.

3831. "Protecting and insulating underground telegraph wires." P. JENSEN. (A communication from W. E. Prall and Harry Obrick.) Consists of a metallic projecting pipe provided with an interior insulating tube or casing, which is made in sections so as to be easily introduced into the metallic pipe as it is laid, and which is made of asbestos, glass, fibre, slagwood, or other substance in combination with glue or other suitable cohesive substances. (*Provisional only.*)

3858. "Galvanic batteries." JOHN IMRAY. (A communication from Adèle Engström.) Dated Sept. 25. 4d. Relates to a construction of galvanic battery cell or element suitable for production of a constant current, the tension of which may be varied when desired.

3875. "Electric lighting." C. W. HARRISON. Dated Sept. 25. 6d. Relates to the manufacture of carbons made of lamp-black, wood pulp, or starch mixed with napthaline, pitch, or resin dissolved in boiling tar and maintained at a temperature of 250° F. The negative electrodes are also immersed in a neutral solution of iron, and thus are formed, when they are baked at a white heat, carbide of iron electrodes or conductors. Also a new current regulator is described.

City Notes.

Old Broad Street, May 12th, 1880.

GREAT NORTHERN TELEGRAPH COMPANY OF COPENHAGEN.—At the annual general meeting, held at Copenhagen, on the 24th April, 1880, F. Zahle, Esq., presided. The chairman, C. F. Tietgen, Esq., in reporting upon the Company's business generally, was glad to be able to say that the result of the past year's working had been very good, in fact, it had been the most favourable ever attained since the existence of the Company, and this, notwithstanding difficulties which the directors had had to contend with. The difficulties referred to above, mainly consisted in the interruptions of the cables. In the far east the cables had not suffered so much in this respect as in former years, and as the Company had their own repairing steamer in those waters, the repairs had been effected very speedily, in fact, the average of the interruptions had only been four days. In Europe, on the contrary, the cables had been damaged more frequently than in former years. The cause of these interruptions had been the same as usual, viz., breakages caused by ships' anchors and by trawlers. Hitherto the Company had, in order to restore these cables been obliged to rely upon the use of ordinary steamers, temporarily fitted up for the purpose, but as this was not only very costly, but gave rise to much loss of time, the directors had decided that the Company should acquire a ship of their own, specially built and supplied with all the latest improvements for this purpose. This cable steamer had been ordered of the Burmeister and Wain Company, at Copenhagen, the builders of the Company's repairing ship in the far east, the "H. C. Örsted," which had given satisfaction in every respect. The new ship would be somewhat larger than the latter and would be completed by the end of June next. The cost of the ship with full equipment, cable machinery, instruments, &c., would be about £22,000. Instead of investing the whole sum appropriated for the reserve fund, the above amount had been retained in cash in order to pay for the ship. Once in possession of that ship, the repairs would in future be effected at a considerably smaller cost than hitherto, and as a great saving in time would be gained an increase in the traffic receipts would naturally follow. Traffic.—In 1879, the receipts had, according to the traffic returns, been 5,195,168 francs compared with 5,087,816 francs in 1878, showing an increase of more than 100,000 francs. This increase was mainly attributable to the improvement in the traffic during the latter months of the past year, when a revival of trade first became apparent. During the early months of this year the same improvement has steadily manifested itself. It would be remembered that at the St. Petersburg Conference in 1875, the *word rate* was introduced for all extra-European traffic, and the results of the working of that system being satisfactory, it had been decided at the London Conference last year to extend it to the European traffic. There could be no doubt that by degrees the new rule would be appreciated by the general public, as messages containing as few as three words might now be transmitted at a very low charge, whereas formerly the lowest charge was made up for 20 words, however short the message might be. It was, after the short experience since the 1st April, impossible to say what the exact practical result would be for the Company, but considering that the very important traffic between Great Britain, Russia, and the Scandinavian countries, which passed over the Company's lines, related principally to mercantile and shipping interests, there were reasonable prospects of a further increase in the amount of the general traffic

passing over the Company's lines. Having regard to the present and the prospective augmentation of the traffic, and also to the fact that trawl fishing in the North Sea was fast increasing, in consequence of which the cables would be more liable to be damaged than formerly, it would be necessary to be prepared with the means to maintain an efficient service on all the Company's cable routes. The directors had therefore now under consideration the advisability of laying another cable from Great Britain to the Scandinavian countries. The question of how to carry out this intention in the most practical manner would to some extent depend upon the result of negotiations which would now be carried on with the different governments. The reserve fund would suffice for the expense incurred by this addition to the number of the Company's cables, but it would perhaps be more expedient not to absorb that fund, and instead thereof to obtain the required capital by the issue of 5 per cent. debentures, which might now easily be placed at par, and the interest of which would not form a heavy charge upon the Company's revenue. The directors would, however, when the proper time arrived, not fail to submit this question to the shareholders at an extraordinary general meeting. From the working account, it would be seen from the accounts that the gross receipts for the year 1879 had, including a balance of £14,837 11d., brought forward from 1878, amounted to £222,493 12s. 5d., whereas the total expenses had been £63,970 4d., leaving a net revenue balance of £158,523 12s. 1d.; out of this the interim dividend, at the rate of 5 per cent. per annum, already paid, absorbed £75,000. It was now proposed to deal with the remaining £83,523 12s. 1d. as follows:—To reserve and renewal fund, £44,444 8s. 10d.; to contribution to the pension fund of the staff, £503 9s. 3d.; to renumeration to the directors, £1,500; to extra dividend on 150,000 shares at the same rate as last year (2/9), £20,833 6s. 8d.; to balance to be carried forward to next account, £16,242 7s. 4d. Out of the amount referred to above, Kr. 350,000 4 per cent. Royal Danish Bonds, equal to £18,375, has been invested. The remainder has been retained in cash to meet the expense of the new repairing ship. The accounts were then passed, and discharge given to the directors.

FROM the Great Northern Telegraph Company we learn that the Japanese Telegraph Administration announces that henceforth a charge of ten dollars per annum will be made for all abbreviated addresses of receivers of messages registered in Japan. The addresses now registered will remain in force until the 1st September, this year, when they will be cancelled, if the above fee of ten dollars is not paid. The same administration announces that from the 1st July next their terminal rate for Nagasaki messages will be the same as for all other stations in Japan. The rate for messages transmitted by this Company's lines from this country to Nagasaki (hitherto 8s. 4d. per word) will therefore from that date be 9s. 3d., the same as to all other stations in Japan.

BRAZILIAN SUBMARINE TELEGRAPH COMPANY (Limited).—At the thirteenth half-yearly general meeting of the proprietors of this Company, held on May 7th, at the City Terminus Hotel, under the presidency of Lord Monck, the Chairman, in moving the adoption of the report, said that the first point to which he wished to draw attention was the amount of receipts for the half-year ending 31st December, 1879. They amounted in the gross to £77,504, which, compared with the previous half-year, showed an increase of £2,421, but it was not fair to compare one half with that which preceded it, as one half was more productive than the other. The present, however, as compared with the corresponding period of last year, showed an increase of £12,408. From the summary of traffic receipts they would observe that there had been a gradual but small progressive increase from the beginning of about £3,000 or £4,000 a year. The increase in this half-year was of a more substantial character. The increase was still going on, and he expected that the result of the current half-year would be better than any half-year they had had. This was in itself a subject of congratulation. Sir J. Anderson seconded the motion. A Shareholder urged that the dividend might be increased by 1 per cent. and still leave a good sum to be carried to reserve. Mr. Marshall concurred. Several other shareholders also urged that a smaller amount should be carried to reserve, in order that the dividend might be increased. Mr. Warren spoke in favour of continuing to build up the reserve until the increased dividend could be safely declared. The Chairman said that if the board, consistently with their duty, could pay a larger dividend next half-year they would do so. The report was then adopted, and a vote of thanks to the Chairman closed the proceedings.

WEST INDIA AND PANAMA TELEGRAPH COMPANY.—The sixth ordinary general meeting of the West India and Panama Telegraph Company (Limited), was held May 12th, at the Cannon-street Hotel. Mr. C. W. Earle, chairman of the board of directors presided. The accounts for the six months ending 31st Dec., 1879, showed the amount to credit of revenue to be £35,630 7s. 1d., and the expenses have been £22,474 19s. 7d., leaving a balance of £13,155 7s. 6d., which, with the balance of £1,631 16s., brought from last half-year's account, makes a total of £14,787 3s. 6d. Of this sum the directors have carried £2,000 to reserve, leaving £12,787 3s. 6d. available, which it is proposed to deal with as follows, viz.:—First preference shares, half-year's dividend to 31st Dec., 1879, at 6 per cent. per annum, £10,368 18s. Second preference shares, half-year's dividend to 31st December, 1879, at 6 per cent per annum, £1,400 14s. Balance carried to current half-year's account, £1,017 11s. 6d. Total—£12,787 3s. 6d. In consequence of interruption of the Company's cables, the receipts for messages for the past six months are £493 less than those for the corresponding period of 1878. The Company's representations to the Demerara Government as to the non-payment of that colony's subsidy are still under consideration. It is understood that the matter cannot be definitely decided until the combined court meets in June next; under these circumstances the directors have not taken any part of this subsidy into account for the half-year. Several of the Company's cables are at present interrupted, whereby telegraphic communication is cut off beyond Porto Rico. Special boats have been engaged to carry the traffic over the broken sections. The directors have terminated the charter party of the s.s. *Caroline*, temporarily employed as repairing ship in the West Indies, in consequence of extensive repairs required to her boilers. The Company's new repairing ship, the s.s. *Grappler*, arrived in the Thames on the 11th March, and was as speedily as possible fitted with the necessary cable machinery, loaded with 268 knots of cable, and sailed from Gravesend on the 8th April. She may be expected to arrive at St. Thomas about the end of April, and will immediately proceed to repair the interrupted sections. The general reserve account, stated in the balance sheet at £30,489 18s. 4d., had been at 31st December, partly applied to the purchase of cable in stock, and since that date £9,217 8s. of the investments in respect of reserve fund have been realised, and the proceeds applied towards payment for the new ship. In moving the adoption of the report, which was taken as read, the Chairman remarked that although the receipts showed a falling off of £500, in comparison

with the corresponding period in the previous year, there was really a balance to the credit of revenue of about the same sum. This was to be accounted for by the fact that they had received £500 more subsidy from Jamaica, and that they had had to expend less on cable repairs. Of course the latter was only a matter of luck. The general reserve account at the time of the drawing up of the report stood at £30,489. This had been applied partly to the purchase of cable in stock, and £9,217 of the investments in respect of the reserve fund had been realised, and the proceeds applied towards payment for the new ship. They had had a telegram announcing the arrival of their new steamship. She was now on her way to repair some of the interruptions they had had. By hitting upon a fortunate time for the making of the contract for that vessel they had saved a large sum of money. In consequence of the low price of materials the contract price was £14,500, whereas at another time it would be as much as £20,000. The whole cost of that vessel would stand at about £17,000. A very satisfactory judgment had been given by Lord Justice Baggallay as to the claim of £15,000 insurance of the *Investigator*, but no settlement had as yet been obtained. On the contrary, the underwriters had carried the case to the Court of Appeal. As for the general position of the Company, the refusal of the Government to grant a subsidy to them was not, under the circumstances, a very great surprise to him. Besides, no great public attention had been of late called to the West Indies. He was afraid that it required something like an Isandula affair to establish the importance of telegraphic communication, but he thought the Government ought not to forget what had occurred in Jamaica and Barbadoes before these telegraphic cables were laid, and all that might have been obviated in past times had the telegraph been in existence. These matters ought to have some effect on the public mind as to the importance of giving support to such a Company as this. It was at all events satisfactory to find that the refusal of the Government to grant a subsidy had altered the tone of the colonial press towards the Company. The directors were at present considering as to what might be the best time to bring the matter before the Colonial Government, who it was hoped would look upon the matter in a business-like way, and one favourable to the Company. As to the question of the non-payment of the subsidy from Demerara, the point in dispute had to do with what was known as the "Grace Clause." The Attorney-General of Demerara had advised that the Grace Clause once taken advantage of cannot be again exercised. The Attorney-General of England had given an opinion opposed to this. The latter opinion had been placed before the Demerara Government, and it was understood that when the combined courts met in June the whole matter would be discussed. Mr. W. Ford moved the motion for the adoption of the report. The Chairman, in reply to questions, said that unless the Company was aided by larger subsidies the directors would not be inclined to advise the investment of any more capital in the undertaking. The report and the recommended dividend of six per cent. per annum were approved, and the retiring directors were re-elected. A vote of thanks to the chairman and directors concluded the business.

THE GERMAN UNION TELEGRAPH AND TRUST COMPANY, LIMITED.—The report of the directors for the year ending 1st May, 1880, states that the total receipts during the year amount to £12,227 17s. 6d., which, with a balance of £40 4s. 5d. carried forward from last account, make a total of £12,268 1s. 11d. The working expenses for the same period amount to £4621 3s. 3d., leaving a balance of £11,805 8s. 8d. Out of this amount an interim dividend of 5s. 9d. per share was distributed on the 21st January last, and the directors now beg to recommend the payment of a further dividend of 6s. per share, making a total distribution for the year of 11s. 9d. per share, free of income tax, or at the rate of £5 17s. 6d. per annum upon the capital of the Company, and the directors have also written off £74 17s. 3d. from the expenses of formation of the Company, leaving a balance of £51 1s. 5d. to be carried over to the next account. The Company's cable and land lines remain in good order and condition, and business during the last year has been going on in a satisfactory manner. The Telegraph Conference, held last year in London, has led to the introduction of some important changes, such as the general introduction of the one word rate, and the reduction of tariffs, which so far have led to a diminution of revenue. According to the articles of association, H. G. Erichsen, Esq., one of the directors of the Company, retires by rotation, but, being eligible, offers himself for re-election. The auditor, Mr. Henry Dever, also retires, but offers himself for re-election.

THE cable between Hong Kong and the Island of Luzon, by which Manilla is brought into direct telegraphic communication with other telegraph systems, is now complete, and open for traffic. The rate from any place in the United Kingdom is 10s. per word, either by the Eastern Extension or the Indo-European Telegraph Company.

ACCORDING to the report just issued, the net profits of Reuter's Telegram Company (Limited) during the past year, including £113 brought down, were £7,101, out of which the usual interim dividend of 2½ per cent. has been paid. The directors now declare a further dividend of 5 per cent., making 7½ per cent. for the twelve months, and leaving, after the addition of £1,500 to reserve, £108 to be carried forward.

The following are the final quotations of telegraphs:—Anglo-American Limited, 62¾-63¼; Do., Preferred, 92-93; Ditto, Deferred, 35¼-36; Black Sea, Limited, ——; Brazilian Submarine, Limited, 7⅞-8⅛; Cuba, Limited, 9¾-10¼; Cuba, Limited, 10 per cent. Preference, 16¼-16½; Direct Spanish, Limited, 1¾-2¼; Direct Spanish, 10 per cent. Preference, 10¾-11¼; Direct United States Cable, Limited, 1877, 11⅛-12⅛; Scrip of Debentures, 100-102; Do., £50 paid, par-2 pm.; Eastern, Limited, 8¾-9; Eastern 6 per cent. Preference, 12¼-12½; Eastern, 6 per cent. Debentures, repayable October, 1883, 101-104; Eastern 5 per cent. Debentures, repayable August, 1887, 101-103; Eastern, 5 per cent., repayable Aug., 1899, 102-104; Eastern Extension, Australasian and China, Limited, 9-9¼; Eastern Extension, 6 per cent. Debenture, repayable February, 1891, 107-110; 5 per cent. Australian Gov. Subsidy Deb. Scrip, 1900, 102-104; Ditto, registered, repayable 1900, 102-105; German Union Telegraph and Trust, 8¾-9¼; Globe Telegraph and Trust, Limited, 6-6¼; Globe, 6 per cent. Preference, 11⅛-11½; Great Northern, 9¼-10; Indo-European, Limited, 24-25; London Platino-Brazilian, Limited, 5¼-5½; Mediterranean Extension, Limited, 3-3⅛; Mediterranean Extension, 8 per cent. Preference, 10¼-11⅛; Reuter's Limited, 10-11; Submarine, 230-240; Submarine Scrip, 2⅛-2⅜; West Coast of America, Limited, 2-2¼; West India and Panama, Limited, 1¾-2; Ditto, 6 per cent. First Preference, 8-8¼; Ditto, ditto, Second Preference, 7-7⅛; Western and Brazilian, Limited, 7⅛-8; Ditto, 6 per cent. Debentures "A," 100-103, Ditto, ditto, ditto, "B," 100-103; Western Union of U. S. 7 per cent., 1 Mortgage (Building) Bonds, 117-122; Ditto, 6 per cent. Sterling Bonds, 103-105; Telegraph Construction and Maintenance, Limited, 34-34½; Ditto, 6 per cent. Bonds, 104-108; Ditto, Second Bonus Trust Certificates, 3⅛-3⅜; India Rubber Co., 14½-15; Ditto, 6 per cent. Debenture, 104-106.